

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(c), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(c) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/21/2010 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 14-16, 18-19, 21-22, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen et al (US 5,980,629) in view of Watanabe et al (US 6,106,610) or Kemmochi et al (US 6,641,663).

In a method of forming a crucible for production of silicon single crystals, note entire reference, Hansen et al teaches a crucible has inner and outer coatings of a devitrification promoter (col 3, ln 1-50 and col 4, ln 40-55). Hansen et al also teaches granular polycrystalline silicon is loaded into the crucible (col 3, ln 50-67) and the devitrification promoter is preferably barium, magnesium, strontium or beryllium (col 6, ln 20-5). Hansen et al also teaches devitrification promoters includes metal oxides, carbonates, oxalates and ion pairs of a metal cation and organic anions (col 6, ln 1-65), this clearly suggests applicant's metal salts, metal organic acid salt, and barium carbonate.

Hansen et al does not teach the crystallization promoter is dispersed in a silica matrix. Hansen et al is not particular about the method used to coat the surface of the crucible.

In a method of forming a crucible, note entire reference, Watanabe et al teaches a crystallization promoter can be used either alone or as a mixture with a powder of synthetic silicon dioxide to form a translucent quartz glass layer. Watanabe et al teaches depositing a synthetic silicon dioxide powder sufficiently impregnated with the aqueous solution, and the layer is formed as a coated film or a solid solution layer on the surface (col 3, ln 30-65 and col 4, ln 1-35), this reads on applicant's crystallization promoter dispersed in a silica matrix. Watanabe et al also teaches a crystallization promoter layer is fused to a base body (col 5, ln 5-30). Watanabe et al also teaches a transparent internal quartz layer (col 5, ln 55-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Hansen et al by fusing the layer with a crystallization promoter dispersed in a silica matrix to the base body as taught by Watanabe et al to improve adherence and improve safety by reducing the risk of inhalation and ingestion of the promoter ('629 col 8, ln 10-35).

In a method of forming a barium doped inner layer on a silica crucible, Kemmochi et al teaches a transparent inner layer **16** wherein the inner layer is doped with barium which crystallizes silica glass (col 5, ln 1-30 and col 6, ln 35-50). Kemmochi et al also teaches inner silica grain and a barium containing compound are placed in a hopper and mixed to ensure uniform distribution of the barium containing compound in the inner silica grain and the barium doped layer is formed by fusing barium in the silica glass, which clearly suggests a crystallization promoter is uniformly dispersed in a silica matrix (col 5, ln 50 to col 7, ln 10). Kemmochi et al also teaches the barium fused silica crucible can be cleaned or etched and handled with the same procedures as for normal silica crucibles with no additional post-manufacturing processing or special handling (col 7, ln 10), which clearly suggests the amount of crystallization promoter does not change with acid washing and has a mechanical strength of at least 6H.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Hansen et al by fusing the layer with a crystallization promoter dispersed in a silica matrix to the base body as taught by Kemmochi et al to enable fine concentration control of barium, and produce a barium fused silica crucible can be cleaned or etched and handled with the same procedures as for normal silica crucibles with no additional post-manufacturing processing or special handling (col 6, ln 30-67 and col 7, ln 1-10).

Referring to claim 14, the combination of Hansen et al and Watanabe et al teaches a concentration of 1×10^{-5} to 1×10^{-8} M/cm² ('610 claims 3 and 11). Overlapping ranges are prima facie obvious (MPEP 2144.05). The combination of Hansen et al and Kemmochi et al teaches 5-150 ppm ('663 col 9, ln 25-35) and concentration of the devitrification promoter is a result effective variable ('629 col 6, ln 30-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the combination of Hansen et al and Kemmochi et al by optimizing the concentration of barium by conducting routine experimentation of a result effective variable.

As to the "transparent coated layer consisting of a crystallization promoter and a silica matrix," the combination of Hansen et al and Watanabe et al teaches a silicon dioxide powder impregnated with a crystallization promoter and is silent to other elements, thus meets the claimed limitation ('610 col 3, ln 30-40). The combination of Hansen et al and Kemmochi et al teaches a transparent inner layer ('663 col 4, ln 40-65; col 5, ln 15-25 and col 6, ln 35-50).

As to the mechanical strength limitation and the coated layer not being scratched and not changing upon acid washing, the combination of Hansen et al and Watanabe et al teaches a similar method of forming a coated layer by dispersing a crystallization promoter within a silica matrix, as applicant; therefore the properties are expected to be the same because a similar method is expected to produce a product with similar properties. Furthermore, the combination of Hansen et al and Watanabe et al teaches the promoter is fused to the base body ('610 col 5, ln 5-30), which clearly suggests that the promoter is strongly adhered to the base body.

As to a crystallization promoter uniformly dispersed, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of

Hansen et al and Watanabe et al by dispersing the promoter uniformly because having uniform properties would have been desirable.

Referring to claims 15, 16, and 18-20, the combination of Hansen et al and Watanabe et al and the combination of Hansen et al and Kemmochi et al does not disclose the claimed method of obtaining the crucible using a partial hydrolyzate of alkoxysilane oligomer and burning, which is a product-by-process claim and the patentability determination of a product-by-process claim is based on the patentability of the product and does not depend on its method of production (MPEP 2113). The combination of Hansen et al and Watanabe et al or the combination of Hansen et al and Kemmochi et al teaches a crucible, which meets all of the claimed product limitations of claim 15. The same arguments apply for claims 16 and 18-20, which specify the liquid used to obtain the crystallization promoter layer. Also, the combination of Hansen et al and Kemmochi et al teaches barium carbonate ('663 col 5, ln 55-67).

Referring to claims 21-24, and 26, the combination of Hansen et al and Watanabe et al and the combination of Hansen et al and Kemmochi et al teaches a crystallization promoter layer **24, 26** on the inside and outside surfaces of the crucible and polysilicon in the crucible. ('629 Fig 1 and col 12, ln 25-35).

Response to Arguments

4. Applicant's arguments with respect to claims 14-16, 18-19, 21-22, 24, and 26 have been considered but are moot in view of the new ground(s) of rejection.

5. Applicant's arguments filed 1/21/2010 have been fully considered but they are not persuasive.

Applicant's argument that the promoter is not uniformly dispersed in the inside surface of the crucible is noted but not found persuasive. Applicant alleges that the promoter containing layer is formed on the internal wall surface of crucible base body. Watanabe et al teaches a crystallization promoter can be used as a mixture with a powder of silicon dioxide to form a coated film or a silicon solution layer on the surface of the internal layer (col3, ln 30-40). Clearly one of ordinary skill in the art would have found it obvious to make a mixture of promoter and silicon dioxide uniform, thus a crystallization promoter being uniformly dispersed in the silica matrix would have been obvious to one of ordinary skill in the art. Also, Watanabe et al teaches the layer containing the crystallization promoter is formed as a coated film on the surface of the internal layer (col 3, ln 30-40), thus clearly suggests at least the inside surface comprises a transparent coated layer.

Applicant's argument regarding Watanabe et al teaches an additional layer coating the crystallization promoter is noted but not found persuasive. Hansen et al teaches a promoter layer on the inside surface. And Watanabe et al teaches a method of forming a promoter layer by forming a mixture of silicon dioxide and crystallization promoter into a coated film or solid solution layer. The sole modification to Hansen et al is how to form a layer containing a crystallization promoter. The additional layer formed by Watanabe et al is not essential to the formation of a crystallization promoter layer, as discussed in the previous responses.

Allowable Subject Matter

6. Claims 27-34 are allowed.

7. The following is an examiner's statement of reasons for allowance: The closest prior art is Hansen et al, Watanabe et al and Kemmochi et al. The prior art teaches forming a promoter containing layer by mixing silicon dioxide and a crystallization promoter. The prior art teaches fusing the mixture onto the surface of the crucible. The prior art does not teach, suggest or provide any rationale for a transparent coated layer is formed by burying a silica sol liquid comprising a metal salt and a partial hydrolyzate of an alkoxyisilane oligomer coated on at least the inside surface of the crucible where the temperature of the burning is greater than 600°C and equal to or less than 1000°C.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

/Matthew J Song/
Examiner, Art Unit 1792